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VACUUM PACKER FOR SMALL AND MEDIUM INDUSTRY

HASMINDA HASSAN

MAY 2009

VACUUM PACKER FOR SMALL AND MEDIUM INDUSTRIES

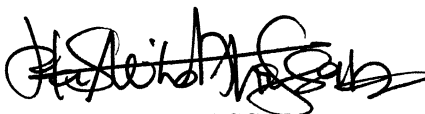
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This report is submitted in partial fulfillment of the requirements for the award of
Bachelor of Mechatronics Engineering

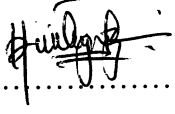
Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

YEAR 2009

“I hereby declare that this report entitle Vacuum Packer for Small and Medium Industry is the result of my own research except as cited in references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.”

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Date : 12/5/09

To my beloved mother and father

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ABSTRACT

Today, Small and Medium Industries (SMI) had extremely developed especially in food technology. As we all know, a lot of technologies has been invented to further improve the quality of the products and its lifetime. Therefore, in order to level up the industry, a lot of researches been carried out and all the people had put all their efforts to advance the technology. Vacuum packer is one of the researches that had been done to further improve the food industry especially in the SMI. Although this type of packaging technique had already been implemented in Malaysia, it is not widely used as the cost of using this product is expensive. Hence, this project is proposed to build the same function of vacuum packer but less in cost so that those in SMI can afford to use this technique and automatically can increase their quality and longer the lifetime of the products. Throughout the project, there will be a lot of studies need to be done on the electronics components, sensor, and others in order to manufacture a vacuum packer according to specifications given.

ABSTRAK

Hari ini, Industri Kecil Sederhana (IKS) semakin berkembang dengan pesat seiring dengan kemajuan dalam teknologi makanan kini. Seperti yang kita ketahui pelbagai alat-alat teknologi telah dihasilkan bertujuan untuk meningkatkan lagi mutu produk makanan dari segi jangka hayat mahupun kualitinya. Justeru itu, berbagai kajian dan usaha telah dibuat untuk menyumbang ke arah kemajuan teknologi makanan ini termasuklah didalam teknologi pembungkusan barang. “*Vacuum Packer*” merupakan salah satu hasil kajian yang mendalam bagi meningkatkan mutu pembungkusan makanan terutamanya makanan segera seperti kerepek, bahan mentah dan sebagainya. Walaupun seperti yang diketahui bahawa produk “*Vacuum Packer*” sebenarnya telah wujud di negara ini tetapi penggunaannya kurang mendapat sambutan dikalangan pengguna-pengguna terutama Industri Kecil Sederhana (IKS) berpunca daripada masalah ketidakmampuan untuk membeli kerana harga produk yang sangat mahal. Oleh yang demikian, tujuan utama projek ini adalah untuk menghasilkan sebuah “*Vacuum Packer*” yang mana masih menggunakan konsep produk yang sedia ada tetapi harga yang lebih murah yang mampu digunakan dikalangan peniaga atau pengeluar dari Industri Kecil dan Sederhana (IKS). Melalui projek ini, pelbagai kajian dilakukan ke atas komponen-komponen elektronik, dan pneumatik dalam menghasilkan sebuah “*Vacuum Packer*” yang memenuhi kriteria-kriteria yang telah dicadangkan.

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LIST OF ABBREVIATION

SMI	-	Small and Medium Industry
IKS	-	<i>Industri Kecil dan Sederhana</i>
V	-	Volt
PVDC	-	Polyvinydene chloride
SMIDC	-	Small and Medium Industries Development Corporation
SMEs	-	Small and Medium Enterprises
SMIs	-	Small and Medium Industries
DC		Direct Current
AC		Alternate Current

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CHAPTER I

INTRODUCTION

Vacuum packaging is one of the packaging techniques in the food industries world. It is used to pack products in an airless environment before the products been market worldwide to prevent the food from spoiled. It removes the atmospheric oxygen from bags and protects foods by limiting the growth of bacteria, fungi and also preventing the evaporation of volatile components. It is also usually used to store a long-term dry foods and short-term fresh foods [1].

1.1 Problem Statement

Vacuum packing is the process of air removing from the inside of the package or container, followed by sealing the package or container to prevent the air from re-entering. The purpose of vacuuming the package before sealing process is to eliminate oxidation, avoid insect infestation, protects its flavour and oils, prevent freezer burn, preserve its natural moisture and to stop moisture contamination [2].

In Malaysia, the Small and Medium Industry (SMI) rarely used this type of sealing process to pack their products as they are still not extensively being exposed to the goodness of vacuum packaging in order to maintain the quality and extend the product's lifetime. The fact that existing vacuum packer is too expensive indirectly had stopped the intention of SMI in using this type of food packaging widely. The existing vacuum packer costs thousands and only a small number of people afford to use it [3].

Thus this project is conducted to build a low cost vacuum packer that can be used in the Small and Medium Industries as one of their packaging techniques.

1.2 Objective

The main objective of this project is to produce a low cost vacuum packer for Small and Medium Industry (SMI) in Malaysia. It is to ensure the end result of this product more or less will equal to the existent vacuum packer but less in cost. The difference between vacuum packers in market with the one that will be produced is that this will use the function of pressure sensor to operate the sealing system. This project combines the different types of systems which are pneumatic and electronics that will make the whole sealing process easier. Other than that, the objectives are to design a simple vacuum sealer, easy to handle with high-quality-material but low in cost.

1.3 Scope of Project

The scope of this project is to build a low cost packaging machine which is vacuum packer that will benefits users especially people in SMI. This project will combine the different type of systems which are pneumatic and electronic in order to function it smoothly.

CHAPTER II

LITERATURE REVIEW

This chapter briefly describes regarding all the information that had been gather along the study of this project.

2.1 History of Packaging

Packaging is an art, science and technology of enclosing or protecting products for distribution, sale, storage and use. It is refer to a process of design, evaluation, and production of package. Packaging can be described as a coordinated system of preparing goods for logistics, warehousing, transport, sale and end use. It contains protects, preserves, transports, informs and sells. It is fully integrated into government, business, institutional, industry and personal use. Packaging has several objectives which are as a physical protection, barrier protection, containment or agglomeration, information transmission, marketing, security, convenience and portion control [4] , [5].

The first packages used the natural materials available during that time such as baskets of reeds, wineskins, wooden boxes, ceramic, wooden barrels and others. The processed materials were used to form packages as they were developed for an example the Iron and tin plated steel were used to make cans in early 19th century. In the late 19th century, paperboard cartons and corrugated fibreboard boxes were first introduced. The packaging advancements in early 20th century included Bakelite closures on bottles, transparent cellophane overwraps and panels on cartons had increased the processing efficiency and improved the food safety. Furthermore, the additional materials such as

aluminium and several types of plastic were developed to incorporate into packages to improve performance and functionality [4].

Packaging can be identified as a several different types as shown in Figure 2.1. As an example, a transport package or distribution package is the package form that is used to ship, store, and handle the product or inner packages. Another type is a consumer package which is directed toward a consumer or household. Packaging can be considered in relation to the type of product being packaged such as medical device packaging, bulk chemical packaging, over-the-counter-drug packaging, retail food packaging, military material packaging, pharmaceutical packaging and others. It is sometimes more convenient to categorize packages by layer or function [4].

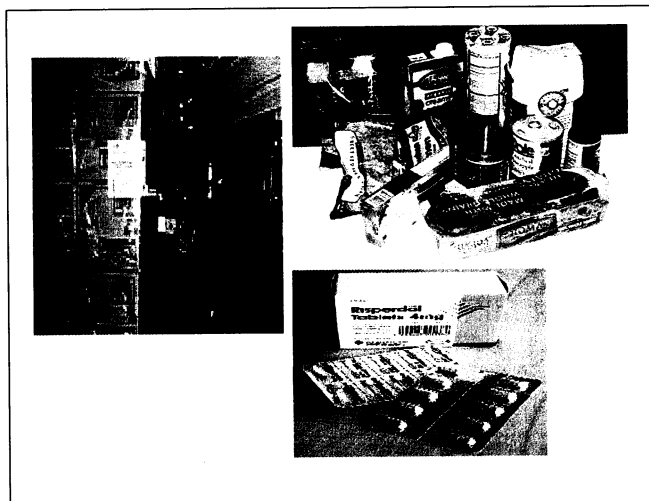


Figure 2.1 : Packaging Type

The layer of packaging is usually being categorized as primary packaging, secondary packaging and tertiary packaging. The primary packaging is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is indirect contact with the contents while the secondary packaging is the outside of the primary packaging. It is also been said to group the primary packages together. The tertiary packaging is usually used for bulk handling, warehouse storage and transport shipping. The most common form is a palletize load that packs tightly into containers [4].

2.2 Food Packaging

The functions of food packaging were defined as to preserve its quality and freshness, add appeal to consumers and to facilitate storage and distribution [6]. Food packaging is one of the most important processes in the food industries where all the labels will be attached together with the package before been sent out to the markets. Packaging plays the main role as to make sure that the lifetime of the products will be equals as it suppose to be. If there is any mistakes during the packaging process, the products will get contaminate and definitely reduce its qualities. It is also been said is used to attract consumers to buy the products. The packages and labels act as the representative and speak for the products with the consumers.

There are a lot of packaging types used such as; Aseptic Packages, Plastic Trays, Bags, Boxes, Cans, Cartons, Flexible Packaging, Pallets and Wrappers. Each and every packaging is for a different type of products, which is which is defined by how sensitive is the product, material and other concerns [5].

Vacuum Packaging is also lies in packaging method used in food industries. Vacuum packaging started since late 1940s when there is one company; *Dewey and Almy Chemical Company* brought a unique French packaging development into United States. They implement the technique (vacuum packaging) on the whole turkeys using rubber stretch bags. Generations by generations, this technique had expanded and improves by time. From the rubber stretch bags, they had used the PVDC shrink bags and now they had improved by using the aluminum, nylon and others. The concept then led to the wide commercial use of vacuum packaging for the refrigerated and frozen food [7] , [8].

Vacuum packaging involves the placing, either manually or automatically, of a perishable food inside a plastic film package and then, by physical or mechanical means, removing air from inside the package so that the packaging material remains in close contact with the product surfaces after sealing [7].

2.3 Types of Vacuum Packaging

Vacuum packing is to remove all the atmospheric air inside the packaging to prevent it from being spoilt by the fungi or bacteria. Vacuum packed is widely used in all industries to pack a lot of products such as food, medical and electronics components and parts. Even if it is a different product, the reason of being vacuum packed is still the same, which is to longer the lifetime of the products. Vacuum packaging has variety of air-removal system and packaging equipment used such as nozzle vacuuming, chamber vacuuming, thermoforming, and others [7].

2.3.1 Nozzle Vacuuming

Nozzle vacuuming is one of air removal method as shown in Figure 2.2. A nozzle connected to a vacuum pump is inserted inside the open end of a preformed bag or pouch. The vacuum or air removal level using the nozzle system is seldom very high, as the packaging material quickly collapses onto the product surface, blocking significant further air removal. Today, nozzle vacuuming is widely used for packaging whole fresh and

frozen poultry, fresh-cut vegetables and bulk packaging of fresh meats, poultry, fish, processed meats, nuts, and others [7].

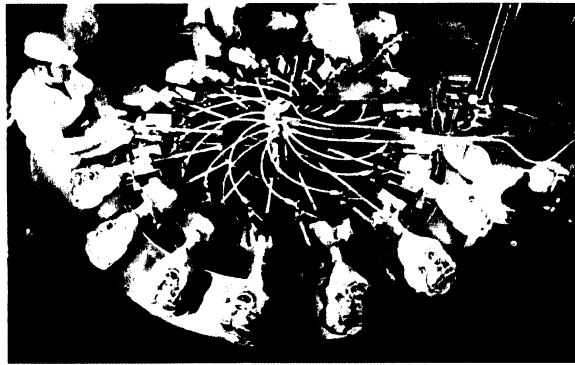


Figure 2.2 : Nozzle Vacuuming

2.3.2 Chamber Vacuuming

Chamber vacuuming is when the product is placed inside the flexible plastic film package, which is loaded into the bottom section of a vacuum chamber. This type of vacuuming machines generally employ heat-seal closures and are available from manual through fully automatic rotary high-speed units. They are widely used to package fresh primal and sub primal meat cuts, smoked and processed meats, and natural cheeses [7]. The chamber vacuuming can be seen in Figure 2.3.



Figure 2.3 : Chamber Vacuuming

2.3.3 Thermoforming

Thermoforming in Figure 2.4 is a manufacturing process where plastic sheet is heated to a pliable forming temperature, formed to a specific part shape in a mold, and trimmed to create a usable product. The sheet, or "film" when referring to thinner gauges and certain material types, is heated in an oven to a high-enough temperature that it can be stretched into or onto a mold and cooled to a finished shape [7].



Figure 2.4 : Thermoforming

2.4 Heat Sealing

When there are two or more plastics need to be fabricated together, the best way to weld them is by using the heat sealing. The plastics is placed in the heat sealing machine before they been weld by using a large punch pressure with heat to melt the plastics [7].

2.5 Types of Heat Sealing

There are lots of methods used in heat sealing. Different type of methods is used for a different type of products and packaging bags. Each and every products need to be well-known before the type of sealing method is used on them. This is to ensure that the quality of the product remains and the method will not spoil the products.